Claims

1. Method for friction welding, whereby one of the parts to be joined is oscillated by means of an electromagnetic oscillator, characterised in that the oscillator is electrically braked after controlled stimulation of oscillations and a pre-determinable oscillation period.

2. Method according to claim 1, characterised in that the stimulation of oscillations and the braking action are effected by alternately energising two electromagnets with opposing actions, that in dependence on the respective direction of movement of the oscillator, upon stimulation of the oscillations an electromagnet that supports the movement is energised and upon braking an electromagnet that inhibits the respective movement is energised, and that during the braking action the energisation process is halted once a predetermined oscillation amplitude has been reached.

3. Method according to any one of the preceding claims, characterised in that the stimulation of oscillations and the braking action in each case take less than 80 ms.

4. Arrangement for friction welding, in which an oscillator is provided by means of which one of the parts to be joined is oscillated and which is powered by electromagnets with opposing actions, characterised in that an output of a displacement sensor (11) which registers the respective position of the oscillator (4, 5, 6) is joined to an input of a controller (12) which is linked on the output side to inputs of a power-circuit output stage (13) for energisation of the electromagnets (2, 3).

5. Arrangement according to claim 4, characterised in that the controller (12) activates the power-circuit output stage (13) in such a manner that in dependence upon the respective direction of movement of the oscillator (4, 5, 6) an electromagnet (2, 3) supporting the movement is energised.

6. Arrangement according to either of claims 4 or 5, characterised in that an electromagnet (2, 3) inhibiting the respective movement is energised fpr braking, and that during the braking operation the energisation is halted once a predetermined oscillation amplitude has been reached.

7. Arrangement according to any one of claims 4 to 6, characterised in that the power-circuit output stage (13) is constituted from a first bridge arm comprising two solid-state switching devices (T3, T6) connected in series, with parallel-connected free-wheeling diodes (D3, D6), and two further bridge arms which respectively comprise a series-parallel connection for a solid-state switching device (T1, T2) and a diode (D4, D5), that the coils of the electromagnets (2, 3) are connected on the one hand between the junction point of the solid-state switching devices (T3, T6) of the first bridge arm and, on the other hand, a respective junction point of the other bridge arms, that the solid-state switching devices (T3, T6) of the first bridge arm are activated at the oscillation frequency and the solid-state switching devices (T1, T2) of the further bridge arms are activated in a pulse-width-modulated or tolerance-band-regulated manner, and higher frequencies than the oscillation frequency may result, depending on the control state.

8. Arrangement according to claim 7, characterised in that the diodes (D4, D5) of solid-state switching devices (T4, T5) are constituted with the free-wheeling diodes (D4, D5) connected in parallel.

9. Arrangement according to claim 8, characterised in that the energisation of the electromagnets (2, 3) is alternated by way of the other bridge arms from one operating cycle to the next.

10. Arrangement according to any one of claims 4 to 9, characterised in that means for constituting a trigger signal to energise the respective electromagnet (2, 3) are configured in such a way that the trigger signal occurs a predeterminable fraction, preferably one quarter, of the length of an oscillation after an oscillation's passage through zero.

11. Arrangement according to any one of claims 4 to 10, characterised in that the controller (12) incorporates an integral-action component which is pre-set at a substantial level right at the start.

12. Arrangement according to any one of claims 4 to 11, characterised in that the oscillator (4, 5, 6), inclusive of its resilient mounting (5) and the workpiece holder (6), the displacement sensor (11), the controller (12), the power-circuit output stage (13) and the electromagnets (2, 3), form an oscillating circuit whose resonant frequency is

substantially determined by the natural frequency of the oscillator (4, 5, 6), inclusive of the latter's resilient mounting (5) and the workpiece holder (6).